Problem Set 1-4

Reading Analysis

From what you have read in this section, what do you consider to be the main idea? Think of a real-world example, other than the one in the text, in which the value of one variable depends on the value of a second variable and the value of the second variable depends on the value of a third variable. In your example, which is the inside function and which is the outside function? For there to be a value of the composite function, what must be true of the value of the inside function?

Quick Review

Q1. What transformation of f is represented by $g(x) = 3f(x)$?

Q2. What transformation of f is represented by $h(x) = 5 + f(x)$?

Q3. If g is a horizontal translation of f by -4 units, then $g(x) =$ ___?___.

Q4. If p is a horizontal dilation of f by a factor of 0.2, then $p(x) =$ ___?___.

Q5. Why is $y = 3x^5$ not an exponential function, even though it has an exponent?

Q6. Write the general equation of a quadratic function.

Q7. For what value of x will the graph of $y = \frac{x-3}{x-5}$ have a discontinuity?

Q8. Sketch the graph of $f(x) = |x|$.

Q9. Find 40% of 300.

Q10. Which of these is a horizontal dilation by a factor of 2?

A. $g(x) = 2f(x)$ **B.** $g(x) = 0.5f(x)$

C. $g(x) = f(0.5x)$ **D.** $g(x) = f(2x)$

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1. *Flashlight Problem:* You shine a flashlight, making a circular spot of light on the wall with radius 5 cm. As you back away from the wall, the radius increases at a rate of 7 cm/s.

a. Find the radius at times 4 s and 7 s after you start backing away.

b. Use the radius at times 4 s and 7 s to find the area of the spot of light at these times.

c. Why can it be said that the area is a *composite function* of time?

d. Let t be the number of seconds since you started backing away. Let $r(t)$ be the radius of the spot of light, in centimeters. Let $a(r(t))$ be the area of the spot, in square centimeters. Write an equation for $r(t)$ as a function of t. Write another equation for $a(r(t))$ as a function of $r(t)$. Write a third equation for $a(r(t))$ explicitly in terms of t. Show that the last equation gives the correct area for times $t = 4$ s and $t = 7$ s.

2. *Bacteria Culture Problem*: When you grow a culture of bacteria in a petri dish, the area of the culture is a measure of the number of bacteria present. Suppose that the area of the culture, $A(t)$, in square millimeters, is given by this function of time t, in hours:

$A(t) = 9(1.1^t)$

a. Find $A(0)$, $A(5)$, and $A(10)$, the area at times $t = 0$ h, 5 h, and 10 h, respectively.

b. Assume that the bacteria culture is circular. Find the radius of the culture at the three times in part a.

c. Why can it be said that the radius is a *composite function* of time?

d. Let R be the radius function, with input $A(t)$, the area of the culture. Write an equation for $R(A(t))$, the radius as a function of area. Then write an equation for $R(A(t))$ explicitly in terms of t. Show that this equation gives the correct answer for the radius at time $t = 5$ h.

3. *Shoe Size Problem*: The size shoe a person wears, $S(x)$, is a function of the length of the person's foot. The length of the foot, $L(x)$, is a function of the person's age.

a. Sketch reasonable graphs of functions S and L. Label the axes of each graph with the name of the variable represented.